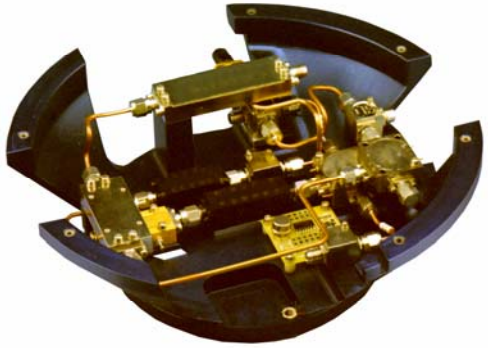
Sandia Remote Sensing E-Magazine

A publication featuring what's new in Remote Sensing Technology at Sandia National Laboratories



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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

NNSA National Nuclear Security Administration

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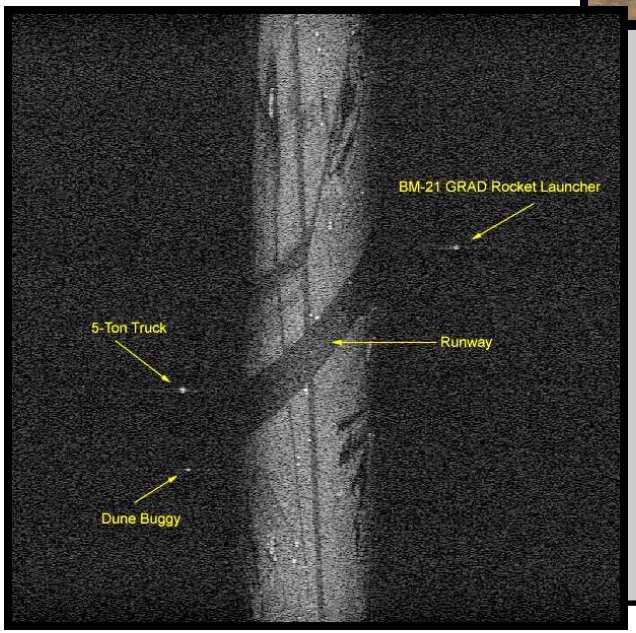
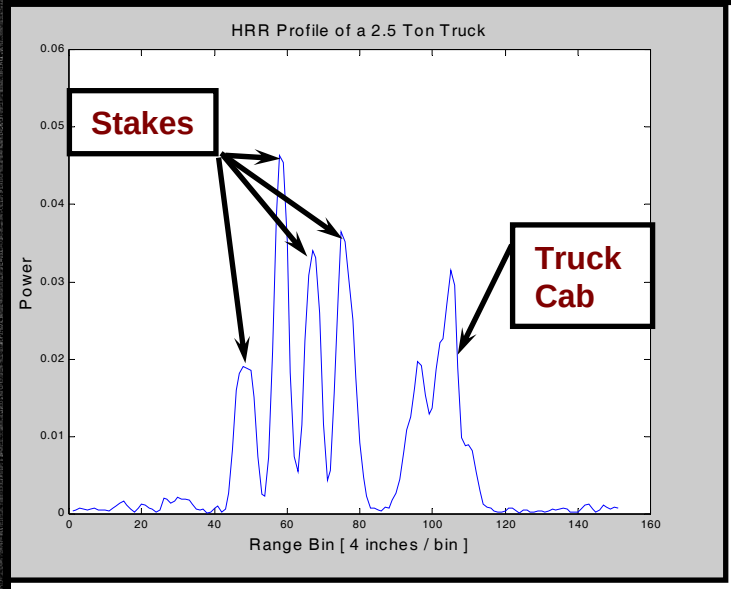
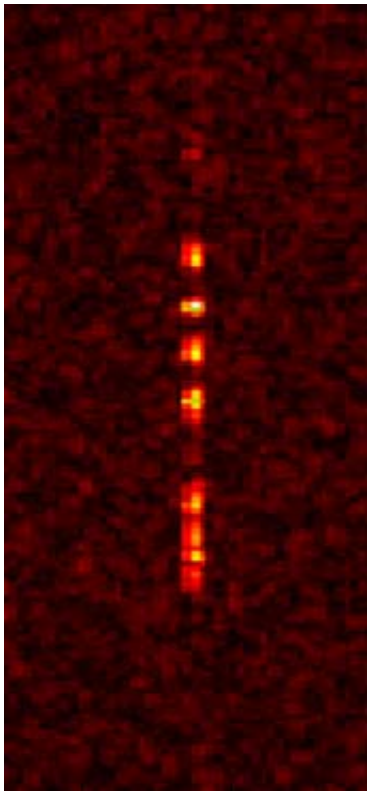
High-Range-Resolution (HRR) GMTI

The unique ultra-fine range resolution of Sandia designed radar systems allow High-Range-Resolution (HRR) Ground Moving Target Indication (GMTI). Current Sandia R&D efforts are exploiting vehicles' unique range profiles for moving target discrimination and identification.





Range (4-inch resolution)



Doppler

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miniSAR

Intersection on Kirtland AFB: 4-inch resolution, 3.3 km range, 20050519:PASS007

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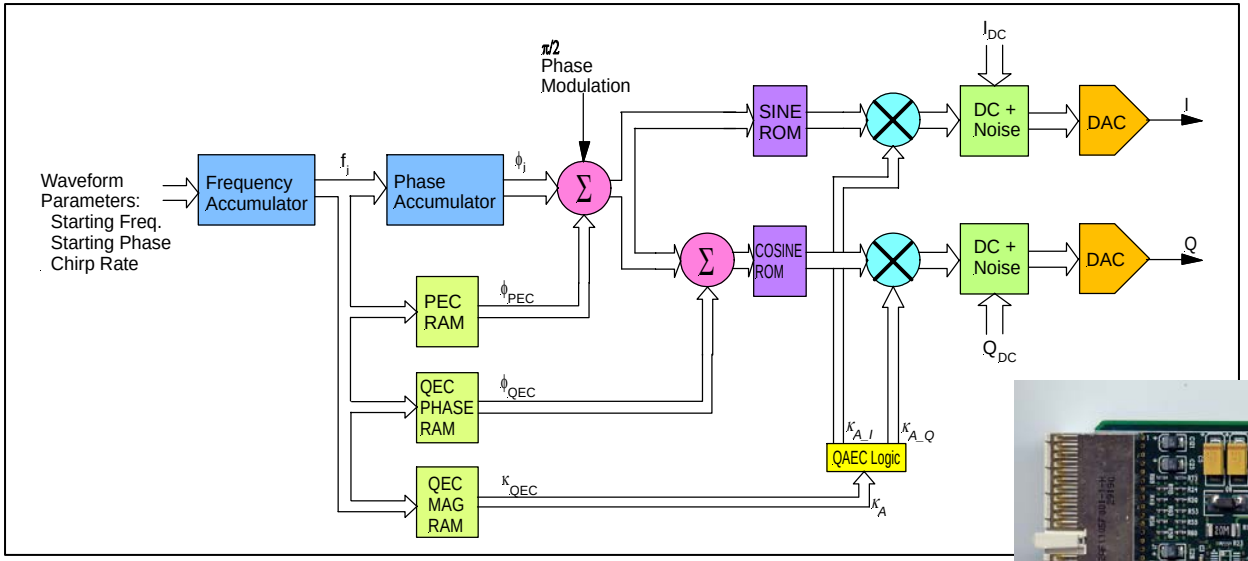
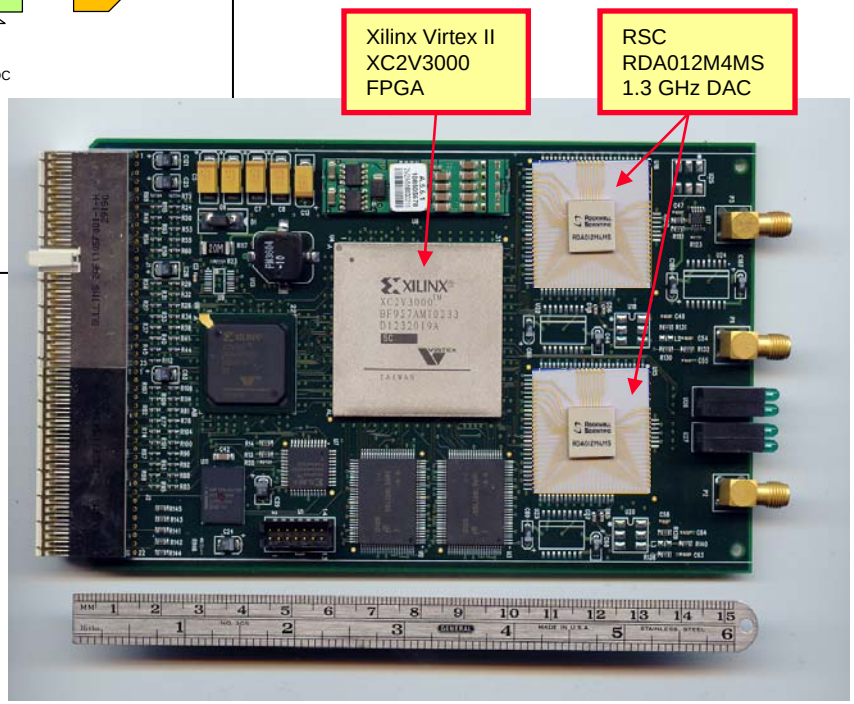
Quadrature Digital Waveform Synthesizer (QDWS)



- **Single cPCI card**
- **1.2 GHz clock**
- **Sine ROM: 16 bit in, 13 bit out**
- **48 bit double accumulator**
- **Programmable phase, frequency, chirp**
- **Dynamic phase/amplitude/balance correction**
- **Quadrature output for SSB mixing**



A principal enabling technology for Sandia radars' exceptional image quality is the versatile and agile waveform generator. This QDWS was developed for Sandia's MiniSAR project, and directly generates a high-fidelity Linear FM chirp with nearly a 1 GHz bandwidth. Deleterious effects of subsequent frequency multiplication (required for ultra-fine range-resolution) are kept to a minimum. Error correction circuits pre-warp the output signal to compensate for non-linearity and other non-ideal component characteristics in the subsequent RF and microwave circuits.

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Recent Accomplishments/ Publications/Patents

- GMTI: Hardware modifications to our testbed radar front end have been defined and the block diagram has been completed. Detailed wiring diagrams are being generated. Component level testing for the new front end electronics will begin shortly. The basic design for the new monopulse antenna feed has been defined and a 3D full-wave EM model is being developed. This will allow initial antenna performance parameters to be evaluated. Software system design changes are currently being defined.
- We spent some time processing Ultra High Range Resolution (UHRR) Ground Moving Target Indicator (GMTI) data. The micro-Doppler information that is visible in this data showed interesting phenomenology that will be useful in the future for identifying and characterizing moving targets.
- Data Collection / Testbed Activities: We are defining a new phase history data format and developing the supporting software tools in order to supply raw phase history data to our customers. We have a working version of a converter that converts one of our current formats to the new format and are working on reader libraries to accompany the data. We are just beginning to write code that will apply differential GPS corrections and form images.
- Image Enhancement: We are continuing to investigate the use of multiple phase-centers for resolving IFSAR phase ambiguities and the SAR layover problem. Currently, we are investigating the possibility of using only the phase from three pairs of phase-centers to resolve SAR layover. This would extend our previous work that uses both the magnitude and phase from two pairs of phase-centers. The “phase-only” approach has the potential advantage of being more reliable since phase measurements are usually more reliable than magnitude data.
- Algorithm Development: A modified enhanced-efficiency Polar Format algorithm was developed. A report detailing this is being written.
- Image Quantization Effects: We finished the study on reduced-image-bandwidth effects on Coherent Change Detection (CCD).

- **D. G. Thompson, "Correlation and Image Compression for Limited-Bandwidth CCD", Sandia Report SAND 2005-3402, June 2005.**

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Additional Information

Visit the following link for additional information:

www.sandia.gov/radar/sar.html

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